DOCUMENT RESUME

ED 101 374 CS 201 835

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TITLE A Review of Some Indices of Language Development. Studies in Language Education, Report No. 15.
INSTITUTION Georgia Univ., Athens. Dept. of Language Education.
PUB DATE Mar 75
NOTE 16p.

EDRS PRICE MF-$0.76 HC-$1.58 PLUS POSTAGE
DESCRIPTORS Indexes (Locaters); *Language Development; *Language Research; *Literature Reviews; *Measurement Instruments; *Syntax; Writing

ABSTRACT

This document reviews some of the indices of language development which have been constructed since the Anderson study of 1937. In addition to the findings of Anderson, the T-unit proposed by Hunt (1965), the measure of T-unit length and mean number of sentence-combining transformations per T-unit developed by O'Donnell, Griffin, and Norris (1967), the instrument for collecting comparable samples of writing from children at various grade levels developed by O'Donnell (1968), the syntactic complexity scale developed by Endicott (1973), and the Syntactic Density Score developed by Golub and Kidder (1974) are discussed. (HOD)

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A REVIEW OF SOME INDICES OF LANGUAGE DEVELOPMENT

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March 1975

CS 201 835

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The quest for an objective and reliable index of children's language development was begun many years ago. In a study reported nearly forty years ago, Anderson (1937) evaluated by statistical methods three indices of language development. He analyzed data on sentence length and pronoun index but was primarily interested in the subordination index that had been devised a short time earlier by LaBrant (1933).

Anderson was concerned with the generality of LaBrant's index and in the possibility of developing an easily applied and uniform measuring device. Because of such variables as composition length, subject matter, and situations in which language is used, he drew negative conclusions about generalized application of the subordination index. He recognized, however, the existence of ". . . a fertile field for the development of indices based on common subject matter, well-categorized scales, and adequate samples from the standpoint of length of passage."

Despite Anderson's findings, subsequent investigations of children's language relied heavily on mean sentence length and the subordination index; and, during the following twenty-five years, not much progress was made toward an easily applied and uniform index of language development. Techniques of linguistic analysis developed in the early 1960's however, offered new hope that such an index could be devised.

In a study of children's grammatical structures written at three grade levels, Hunt (1965) gave a critical evaluation of the traditional indices of language development and proposed some new indices. Pointing out the

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fact that inadequate punctuation and indiscriminate use of and makes sentence length an unreliable index, Hunt proposed a syntactic unit consisting of one main clause and any subordinate clauses attached to the main clause. Such a unit would be grammatically capable of being considered a sentence; and since it would be a terminable unit, he proposed that it be called a T-unit. This unit could be identified objectively, and it would not be affected by poor punctuation. It would have the added advantage of preserving all the subordination achieved by the student and all of his coordination of words, phrases, and subordinate clauses. It would not preserve the student's coordination of main clauses; but, as Hunt pointed out, excessive coordination of main clauses might be a sign of immaturity rather than maturity. Thus, the elimination of coordinated main clauses from the syntactic unit to be used in language development studies would be a gain rather than a loss.

Hunt called attention to the fact that LaBrant counted coordinated verbs as separate clauses; he contended that only a structure with a subject and a finite verb should be regarded as a clause. Then, having identified a syntactic unit more useful than the sentence and having limited the definition of the clause, Hunt proposed a revision of the subordination index. He proposed that, instead of dividing the number of subordinate clauses by the total number of clauses as LaBrant had done, the total number of clauses should be divided by the number of main clauses. This procedure would give the mean number of clauses per T-unit, which could be converted into the ratio of subordinate clauses to main clauses.

Hunt computed these proposed indices for the materials analyzed in his study and found statistically significant increases in T-unit length,

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clause length, and number of clauses per T-unit from grade four to grade eight to grade twelve. He pointed out that these three measures are interrelated. T-units can be lengthened by either or both of two means: (1) lengthening clauses or (2) increasing the number of subordinate clauses. His analysis, based on techniques of transformational-generative grammar, revealed that syntactic complexity of children's language is reflected in both clause length and number of clauses per T-unit. Hunt demonstrated that T-unit length could be computed by multiplying words per clause by number of clauses per T-unit. Since T-unit length incorporated the other two indices, it seemed evident that T-unit length would be a useful index of structural complexity of language.

O'Donnell, Griffin, and Norris (1967), in their study of children's syntax, computed both mean T-unit length and mean number of sentence-combining transformations per T-unit. Their rationale for the latter measure is stated in part as follows:

> There are transformational rules which designate operations affecting two underlying strings so as to join them or embed one in the other. The process is often called generalized transformation, but it is also referred to as sentence-combining transformation, because its effect is to produce one sentence where otherwise there would have been two (p.16).
>
> Except for coordination of main clauses, sentence-combining transformations may be conceived as embedding one kernel sentence (often, though not always, in reduced form) into another in ways determined by the rules of grammar. This embedding increases the information carrying power of the resulting construction. It may well be supposed, then, that at least for children, the relative density of these transformations within T-units signalizes the degree of maturity attained (p.50).

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These investigators found a positive correlation between increases in number of words per T-unit and number of sentence-combining transformations per T-unit. Since the two measures appeared to be of comparable value as indices of language development, they indicated a preference for mean T-unit length because it was easier to compute. They concluded that "mean length of T-units has special claim to consideration as a simple, objective, valid indicator of development in syntactic control" (pp.98-99).

In order to see whether the indices Hunt proposed could be computed from smaller writing samples, O'Donnell (1968) devised an experimental instrument for collecting comparable samples of writing from children at various grade levels. This instrument required the rewriting of a passage composed of simple declarative sentences. Subjects were asked to rewrite the passage, putting the short sentences together to make longer sentences of varying degrees of structural complexity.

Data resulting from use of the sentence-combining instrument indicated that both clause length and number of clauses per T-unit increased together at the lower grade levels, but that clause length alone accounted for most of the growth in complexity at higher grade levels. Since T-unit length is accounted for by a combination of the two factors, T-unit length was judged to be more useful than either of the other two measures alone as an index of growth in structural complexity over a wide age-range.

In commenting on the results of his study, O'Donnell pointed out both the potential value and the limitations of these indices of language development:

> Although it is evident that clause length, T-unit length and number of clauses per T-unit increase with advance in grade,

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> there are no data to show how consistently these indexes measure the structural complexity of an individual student's writing in various situations (p.6).

But in spite of their limitations, these indices (particularly T-unit length) were subsequently used in numerous studies of children's language development.

Another limitation, obvious to anyone who has attempted to analyze the structure of children's language, lies in the fact that indices based on mean length of syntactic units do not discriminate among the various ways length can be achieved. The T-unit is more satisfactory in this respect than the sentence, but the T-unit can be lengthened in a variety of ways, some of which require a great deal more linguistic maturity than others. The desire to find a more discriminating index of language development has motivated researchers to attempt to develop other indices of structural growth.

One index that appears to have potential capacity to reflect differences in degree of complexity is that proposed by Endicott (1973). He accepts the T-unit as a consistent and useful research tool and offers a psycholinguistic definition of the T-unit as: "the extent to which a child combines units of complexity in language involving suspension of thought and mental manipulation of syntactic structures before he breaks off and begins again" (p.6).

Endicott advances a theoretical model intended to allow the defining of units of syntactic complexity in psycholinguistic terms. This involves the development of a rationale for defining such units, which he hopes will result in a scale of syntactic complexity that will be useable by researchers in language development, psycholinguistics, and readibility. Endicott's

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theoretical model is based on transformational and morphemic analyses, since he considers the manipulation of transformations and the suspension or production of morphemes as phases of mental operations.

The units Endicott proposes to use in constructing the syntactic scale are defined below.

> Co-meme: A unit of complexity in language consisting of four sub-categories: The base co-meme, the syntactic co-meme, the compression co-meme, and the morphemic co-meme.
>
> Base Co-meme: Those morphemes expressed at a level of language which has a one morpheme per-word ratio.
>
> Syntactic Co-meme: A theoretical syntactic operation by which sentences are combined or altered to achieve efficiency or variation of purpose beyond that achieved at a minimal level of language.
>
> Compression Co-meme: The theoretical morphemic burden of deep structure which is compressed into surface structure through combination or deletion transformations.
>
> Morphemic Co-meme: Morphemes other than those expressed by base co-memes, i.e., "The productivity was low." "Productivity" represents one base co-meme: "product," and two morphemic co-memes: "ive" and "ity" (p.7).

The point of reference for Endicott's scale is what he calls a minimal level of language, defined as "a sentence which contains no optional transformations and which, barring tense morphemes, represents a one-morpheme per-word level" (p.7). He proposes to consider phrase structure rules and obligatory transformations only when necessary to adjust the scale for non-standard dialects.

Application of the proposed scale for syntactic complexity is illustrated by examples. The sentences The cloud was ominous and The cloud was black are given as examples of the minimal level of language, i.e., one morpheme

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per word (Endicott does not explain why he regards ominous as a single morpheme). At the minimal level, there is only one co-meme per word and the complexity ratio of each of these sentences is 4/4. The black cloud was ominous has a complexity ratio of 9/9, since it is regarded as a combination of the base co-memes of the two constituent sentences plus the co-memes involved in the combining transformation. Specifically, the sentence is regarded as having five base co-memes, three compression co-memes (one each for the, cloud, and was which are "superimposed"), and one syntactic co-meme. The higher complexity ratio of the latter sentence is regarded as resulting from the application of a syntactic resource beyond the minimal level of language.

Compounding The man walked a mile and The boy walked a mile to produce The man and the boy walked a mile results in a complexity ratio of 12/8. The co-meme count includes eight base co-memes, three compression co-memes, and one syntactic co-meme. The beaten team left the field is regarded as resulting from the transformational combining of The team left the field and Someone beat the team. The complexity ratio of 12/6 is explained by reference to the base co-memes and the several syntactic co-memes associated with the passive, deletion, and adjective transformations involved. The genitive in The boy's dog is a spaniel is accounted for by combining The dog is a spaniel and The boy has a dog. The complexity ratio of 11/6 for the resulting sentence is explained as follows:

> Count one syntactic co-meme, one base co-meme, one compression co-meme for the deletion of "has", two compression co-memes for the superimposition of "dog" and "the", and one morphemic co-meme for the possessive inflection. The count is six co-memes for a genitive (p.11).

To emphasize the usefulness of the scale as an indicator of level of maturity, Endicott contrasts Their imaginative resourcefulness was a productive factor with The brown dog was a good dog, both of which have a T-unit length of seven words. The former sentence, which obviously represents a relatively high level of language maturity, has a complexity ratio of 24/7; the latter sentence has a complexity ratio of 15/7.

Endicott recognizes the possibility that various interpretations of a transformational analysis of language might be applied in the derivation process. He says the derivation of values is equivalent to exercising the predictive function of the theory. Thus, if researchers disagree on particular derivations, their differences can be resolved by comparison of predictions and research results. He also recognizes the necessity of isolating a familiarity factor for each structure, since lack of familiarity with words or syntactic operations may block comprehension. He suggests the possibility of determining the difficulty factor for structures by means of cloze techniques.

Another approach to devising a discriminating linguistic index is reported by Golub and Kidder (1974). Their Syntactic Density Score also involves T-unit analysis. It reflects measures of T-unit length and subordinate clause length and also takes into account uses of complex verb phrase expansions and various kinds of embedded structures.

Golub and Kidder report that the first step in developing this measure of syntactic density was to determine how children use specific syntactic structures and which ones seem to predict whether their writing

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will be rated high, medium, or low by their teachers. The items included in the score were selected from sixty-three structures which had been subjected to multivariate analysis. The variables selected were those which correlated highly with teachers' ratings of written language samples. Canonical correlation analysis was performed to assign relative weights to variables according to their contribution to syntactic density.

The Syntactic Density Score incorporates ten items, including words per T-unit, subordinate clauses per T-unit, words per main clause, words per subordinate clause, number of modals, number of be and have forms, number of prepositional phrases, number of possessives, number of adverbs of time, and number of gerunds, participles and unbound modifiers. Each item is assigned a loading, ranging from .20 for words per main clause to .95 for words per T-unit. The loading for each item is multiplied by frequency, and the resulting products are summed and divided by the total number of T-units. The quotient is the Syntactic Density Score, which can be converted to a grade level equivalent. A score of .5 is equivalent to grade level 1, and a score of 10.9 is equivalent to grade level 14. Each grade level differs from the one below it by a Syntactic Density Score value of .8.

The researchers indicate that a 500 word language sample can be scored in about thirty minutes, but for greater convenience they have written a computer program, which they have found to be satisfactorily accurate and consistent. They believe the computerized scoring process has a number of valuable uses:

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> The computer program is useful for classroom teachers who want to diagnose entering behavior levels and subsequent performance levels of their students and to match these levels with reading materials used in class. Examination by a teacher of English of the subscores of a class of students gives an indication of strengths and weaknesses that can guide the teacher's planning of objectives and procedures. The Syntactic Density Score of the variety of novels, textbooks and other reading materials used in specially designed mini-courses or performance-based curriculums can be determined quickly, accurately, and inexpensively (p.1181).

Golub and Kidder recognize that their measure quantifies only the syntactic aspect of language, and they report that they are attempting to prepare a vocabulary intensity index which will make it possible to present a more precise picture of language development.

The indices of language development devised by both Endicott and Golub appear to have greater capacity to discriminate among various kinds of syntactic constructions than do indices such as mean length of T-units, mean length of clauses, and mean number of subordinate clauses per T-unit. Upon close examination, however, a critical observer can hardly avoid concluding that the quest for an efficacious index of language development is not yet ended.

Endicott's proposed scale of syntactic complexity seems to be based on an early stage of transformational theory, and he apparently believes in the psycholinguistic reality of transformational processes. Perhaps The beaten team is more complex than The brown dog, and perhaps the difference can be explained by differences in the number of transformational processes involved in the derivation of the sentences. But it seems quite unlikely that The beaten team is any more complex conceptually than The new team, a structure which would get the same complexity ratio as The

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brown dog. Likewise, it is hard to see how his dog is any more complex than the dog, but the latter structure gets much less weight on the syntactic scale. Probably nobody would argue that Their imaginative resourcefulness was a productive factor is not a complex structure, but it is not at all certain that the complexity can be accounted for by the number of morphemes. Even if number of morphemes is a valid indicator, analysts are likely to encounter occasional difficulty in deciding what to count as a separate morpheme. For example, why shouldn't ominous be counted as omen + ous? And how many morphemes are there in advertised detergents?

Thus, while it is obvious that Endicott's proposed scale has the capacity to discriminate one type of structure from another, it is not so obvious that it would always discriminate in the right direction. The proposed scale probably merits the kind of testing by researchers that Endicott calls for, and perhaps it will prove to be self-correcting. It may be that the familiarity factor can be dealt with in a satisfactory manner, but it appears that a great deal of work remains yet to be done.

Golub's Syntactic Density Scale also has considerable capacity to discriminate types of structures, and it appears to have been developed by empirical procedures. The items included, however, appear to be highly redundant. For example, words per T-unit results from the combined effects of number of clauses and length of clauses, and length of clauses results in part from the remaining items on the scale. Although the statistical procedures may be impeccable, it appears that some arbitrary decisions were made in assigning weights. For example, it is difficult to see why participles should have a loading of .85 when prepositional phrases are valued at only .75.

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Indeed, it is difficult to see why all prepositional phrases should be assigned the same weight since they differ widely in the difficulty level of concepts they represent.

Although Golub's measure has more statistical evidence of validity than Endicott's, it seems likely that the Syntactic Density Score is less precise than it appears to be, particularly when it is converted to grade level equivalency. Given the diversity of individual writing styles, the diverse demands imposed on language by different situations, and other factors yet unknown, it is hard to see how grade equivalence based on a Syntactic Density Score could be used with a high degree of confidence.

Since neither Golub nor Endicott specify how large a sample of writing is needed and how many modes of discourse it should represent, it may be that these specifications have not yet been worked out. If so, O'Donnell's comment on the limitations of earlier measures is still applicable: "there are no data to show how consistently these indexes measure the structural complexity of an individual's writing in various situations."

In spite of the limitations cited above, however, there is little doubt that if the language sample is large enough and diverse enough both Golub's and Endicott's measures will reveal developmental differences in syntactic complexity of language. Since both of them involve rather complex and expensive procedures of analysis, however, it seems appropriate to raise the question of how much better they are than the grosser measures of T-unit length, clause length, and number of subordinate clauses. For if the language sample is large enough and diverse enough, there is little doubt that these less precise measures will also reveal developmental differences in language

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complexity. It may turn out that in spite of lack of precision T-unit length is still the most useful and useable index of syntactic development over a wide age-range and that mean clause length is the best single measure of syntactic complexity at the high school level and beyond. The research required to find out how the various indices compare with one another ought to be done.

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REFERENCES

Anderson, John E. 1937. "An Evaluation of Various Indices of Linguistic Development," Child Development, 8:1 (March), 62-68.

Endicott, Anthony L. 1973. "A Proposed Scale for Syntactic Density," Research in the Teaching of English, 7:1 (Spring), 5-12.

Golub, Lester S. and Carole Kilder. 1974. "Syntactic Density and the Computer," Elementary English, 51:8 (November-December), 1128-1131.

Hunt, Kellogg W. 1965. Grammatical Structures Written at Three Grade Levels. National Council of Teachers of English, Research Report No. 3. Champaign, Ill.: National Council of Teachers of English.

LaBrant, Lou. 1933. "A Study of Certain Language Developments of Children in Grades 4-12 Inclusive," Genetic Psychology Monographs, 14:4 (November), 387-491.

O'Donnell, Roy C. 1968. "An Objective Measure of Structural Complexity in Children's Writing." Unpublished paper delivered at American Educational Research Association meeting.

O'Donnell, Roy C., William J. Griffin, and Raymond C. Norris. 1967. Syntax of Kindergarten and Elementary School Children. NCTE Research Report No. 8. Champaign, Ill., National Council of Teachers of English.